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INSTITUTE OF CHEMISTRY
OF
GREAT BRITAIN AND IRELAND.

(INCORPORATED BY ROYAL CHARTER.)

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REGULATIONS

FOR THE

ADMISSION OF STUDENTS, ASSOCIATES, AND FELLOWS.

EXAMINATION PAPERS:

July, 1904; January and April, 1905.

1905.

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INSTITUTE OF CHEMISTRY
OF
GREAT BRITAIN AND IRELAND.

FOUNDED OCTOBER, 1877.
INCORPORATED BY ROYAL CHARTER OF THE 13th DAY OF JUNE, 1885.

Regulations for the Admission of Students, Associates, and Fellows.

(EXAMINATION PAPERS: 1904-1905.)

Issued by Order of the Council,
RICHARD B. PILCHER,
Registrar and Secretary.
August, 1905.

All Communications with reference to the Regulations should be addressed to

THE REGISTRAR OF THE INSTITUTE OF CHEMISTRY,
30, Bloomsbury Square, London, W.C.

Office Hours: 10 a.m. to 4 p.m.; Saturdays, 10 a.m. to 2 p.m.
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INSTITUTE OF CHEMISTRY.

INTRODUCTION.

1.—The Institute of Chemistry was founded in October, 1877, and incorporated by Royal Charter in June, 1885, to promote the better education of persons desirous of becoming public and technical analysts and chemical advisers on scientific subjects; to examine candidates, and to grant certificates of competency; and to elevate the profession of Consulting and Analytical Chemistry by setting up a high standard of scientific and practical proficiency and by insisting on the observance of strict rules in regard to professional conduct.

2.—In pursuance of the provisions of the CHARTER and BYE-LAWS, the Council have made REGULATIONS for the ADMISSION of STUDENTS, ASSOCIATES, and FELLOWS.

No person can be admitted to any Examination held by the Institute unless he has passed an approved Preliminary Examination and complied with the Regulations as to training.

There are three Examinations for admission to the grade of ASSOCIATE, viz.:—I. A Preliminary Examination in subjects of general education. II. The Intermediate Examination in general theoretical and practical chemistry. III. The Final Examination in a branch of chemistry selected by the Candidate.

In order to become eligible for the Fellowship, an Associate is required to have been continuously engaged for a further term of three years in the study and practice of applied chemistry in a manner satisfactory to the Council.

Any Fellow of the Institute may use the initials 'F.I.C.,' and any Associate of the Institute, the initials 'A.I.C.'

3.—PRELIMINARY EXAMINATION IN SUBJECTS OF GENERAL EDUCATION.

Candidates must pass an approved Preliminary Examination before they can be registered, and they must produce the certificate of having passed the full examination including the following subjects :—

SUBJECTS:

(*a*) English Language.

(*b*) Latin.

(*c*) Mathematics, comprising Arithmetic, Algebra to simple equations inclusive, and Geometry, including Euclid, Books I., II., III.

(*d*) One of the following:—French, German, Italian, any other Modern Language approved by the Council, Greek. or Logic.

Where the certificate does not mention the subjects in which the Candidate passed, a statement, giving this information, must be obtained from the Examining Body.

APPROVED PRELIMINARY EXAMINATIONS.

The Council will accept as an approved Preliminary Examination any examination mentioned below.

NOTE.—Application for information concerning the Regulations of the following Examinations should be made to the respective Examining Bodies.

UNIVERSITIES IN GREAT BRITAIN AND IRELAND.

University of Aberdeen.—Senior Local Examination. Preliminary Examinations for Graduation in Arts or Science.

University of Birmingham.—Matriculation Examination.

University of Cambridge.—Senior or Higher Local Examination. Previous Examination. General Examination.

University of Dublin.—Public Entrance Examination. Examination for the First, Second, Third, or Fourth Year in Arts.

University of Durham.—Examination for a Certificate of Proficiency. Senior Local Examination.

University of Edinburgh.—Senior Local Examination. Preliminary Examinations for Graduation in Arts or Science.

University of Glasgow.—Preliminary Examinations for Graduation in Arts or Science.

University of Leeds.—Preliminary Examination.

University of Liverpool.—Preliminary Examination.

University of London.—Matriculation Examination.

University of Oxford.—Senior Local Examination. Responsions. Moderations.

NOTE.—In some cases a Junior or Lower Grade Examination, conducted by a recognised Examining Body may be accepted, if passed in all of the compulsory subjects at one and the same Examination, *prior to 31st December*, 1901.

PRELIMINARY EXAMINATION.

University of St. Andrews.—Preliminary Examinations for Graduation in Arts or Science. Final Examination for the Diploma of L.L.A.

Royal University of Ireland.—Matriculation Examination.

Victoria University (Manchester).—Preliminary Examination.

University of Wales.—Matriculation Examination.

Other Educational Bodies in Great Britain and Ireland.

College of Preceptors.—Examination for a First Class (or Senior) Certificate.

Glasgow and West of Scotland Technical College.—Preliminary Examination for Diploma Students.

Intermediate Educational Board of Ireland.—Senior Grade Examination.

Oxford and Cambridge Schools Examinations Board.—Higher Certificate.

Scotch Educational Department.—Examinations for Leaving Certificates.

Central Welsh Board.—Senior Certificate Examination.

Universities and Colleges Abroad.

No Certificate from the Bodies mentioned below will be accepted unless it shows:—That the Examination has been conducted by or under the authority of the body granting it; that it includes all the subjects required by the Council, and states that all the subjects of Examination have been passed at one time.

Australasia.

Adelaide University.—Senior Public Examination. First Year Examination in Arts.

Melbourne University.—Matriculation Examination.

Sydney University.—Matriculation Examination. First year Examination in Arts. Senior Public Examination. Entrance Examination for Medicine and Science.

Tasmania University.—Senior Public Examination.

Canada.

Kingston: Queen's University.—Departmental Arts Matriculation Examination.

Manitoba University.—Preliminary and Previous Examinations.

Montreal: University of Bishop's College.—Matriculation Examination.
University of McGill College.—Matriculation Examination.

Newfoundland Medical Board.—Preliminary or Matriculation Examination.

New Brunswick: Universities of Fredericton and Mount Allison College.—Matriculation Examinations.
College of Physicians and Surgeons.—Matriculation Examination.

PRELIMINARY EXAMINATION.

Canada—*continued.*

Nova Scotia: Dalhousie College and University, Halifax.—Matriculation Examination.

Provincial Medical Board.—Preliminary Examination.

Ontario University.—Departmental Arts Matriculation Examination.

Quebec: College of Physicians and Surgeons of the Province.—Matriculation Examination.

Toronto University.—Departmental Arts Matriculation Examination.

Trinity Medical College.—Departmental Arts Matriculation Examination.

Trinity University.—Departmental Arts Matriculation Examination.

Victoria University.—Departmental Arts Matriculation Examination.

Cape Colony.

Cape of Good Hope University.—Matriculation Examination.

Egypt.

The Secondary Education Certificate of the Egyptian Government.

India and Ceylon.

Allahabad University.—Intermediate Examination in Arts.

Bombay University.—Matriculation Examination.

Calcutta University.—First Examination in Arts.

Ceylon Medical College.—Preliminary Examination.

Madras University.—First Examination in Arts.

Punjab University.—Intermediate Examination in Arts.

(In the case of natives of India or other Oriental Countries an Examination in a Classic Oriental Language may be accepted instead of an Examination in Latin.)

Malta.

University of Malta.—Matriculation Examination.

New Zealand.

New Zealand University.—Preliminary Examination.

Otago University.—Preliminary Examination.

Foreign Universities in Europe.

The German Abiturienten-Examen of the Gymnasia and Real-gymnasia; Examinations entitling to the French Diplomas of Bachelier ès Lettres and Bachelier ès Sciences, and other corresponding Entrance Examinations to the Universities.

4.—REGULATIONS FOR THE ADMISSION OF STUDENTS.

1. A Candidate is eligible for registration as a Student at any period during his training, provided that he can produce evidence satisfactory to the Council—

(*a*) That he is not less than 17 years of age.

(*b*) That he has passed an approved Preliminary Examination in the required subjects (see p. 4).

(*c*) That he is, at the time of application, a student at one of the Universities, Colleges, or Schools, approved by the Council (p. 44), or a pupil of a Fellow of the Institute in a laboratory approved by the Council, and that he is *bonâ fide* in course of preparation and training with the object of adopting the profession of Analytical and Consulting Chemistry.

(*d*) That he has paid his first Registration Fee of Five Shillings.

2. The Registration Fee is due on admission and on the first day of January in each year. Any Student who omits to pay his Annual Registration Fee, when due, shall, on a Resolution to that effect being passed by the Council, have his name removed from the Register.

3. All Students of the Institute are required to present themselves for Examination within five years from the date of their admission, otherwise their names will be removed from the Register, unless an extension of time be granted by the Council.

Forms of application can be obtained from the Registrar.

Although not compulsory, it is advantageous to Candidates to register as Students of the Institute, in view of the fact that Registered Students are required to fulfil only those regulations which are in force at the time of registration. Candidates not so registered are required to comply with the regulations in operation at the time of application for admission to the Examinations.

Registered Students receive the "Proceedings," which contain the Reports on the Examinations together with the Pass Lists, Examination Papers and particulars of the practical exercises set. They are also allowed the use of the Library of the Institute, during the same hours as Fellows and Associates.

OBLIGATORY CONDITIONS AS TO TRAINING.

No course of lectures or other instruction in the required subjects will be recognised as part of the curriculum for the Associateship which is not given *in the daytime* by the appointed Professor, in a University, College or School recognised by the Council (p. 44), or, in the case of laboratory work, by a duly appointed Assistant, acting under the supervision of the Professor. Attendance upon such instruction will not be sufficient, unless satisfactory evidence is afforded by the Candidate that the whole of his time has been given to it, either in a recognised College, or in the case of a Student who is a pupil of a Fellow of the Institute (B:—page 11), partly in a recognised Institution and partly under the direction of such Fellow.

ADVICE AS TO TRAINING.

Chemistry, Theoretical and Practical, is to be regarded as the principal subject; the other subjects are subsidiary, and should occupy a relatively small proportion, as a rule not more than one-fourth, of the student's time.

A careful inspection of the Syllabus of each of the Examinations held by the Institute will give the Candidate a good general idea of the extent of the knowledge of chemistry he is expected to possess. In addition to systematic analytical practice, every Candidate should be able to use the microscope, spectroscope, polarimeter, refractometer, and other instruments commonly used in chemical laboratories. He should also be able to draw diagrams of apparatus and of instruments.

Candidates whose aim is to practice in Technical Chemistry are advised to devote particular attention to the study of Physics.

Attention is directed to the importance of Candidates keeping complete records of their practical work. Before presenting themselves for examination, they are required to forward such records for inspection by the Examiners, who will take them into account in deciding the Examination. Candidates are expected to be able to use logarithms in their chemical calculations.

5.—TRAINING AND QUALIFICATIONS REQUIRED FOR THE ASSOCIATESHIP.

Every Candidate for the Examinations for the Associateship is required to produce—

1. A certificate of birth or baptism as evidence of age.

A Candidate under 21 years of age, who has complied with the Regulations, may enter for the Examinations, and, if successful, will be elected to the Associateship on attaining that age.

2. A satisfactory certificate of moral character.

3. A certificate that he has passed an approved Preliminary Examination (see page 4).

4. Evidence that he has completed one of the following schemes of training*, **A** or **B** :—

A.

(*a*) That he has passed satisfactorily through a systematic course of study extending over at least *three academic years*,

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*For Exemptions see p. 12 (Section **6**. Clause 2), and p. 15 (Section **7**, Clause 2).

and has passed the Class Examinations, in **Theoretical and Practical Inorganic and Organic Chemistry,** in one or more of the Institutions recognised by the Council (see p. 44); and that the practical work shall have occupied, on the average, at least 15 hours per week, during the three years.

(*b*) That he has worked for at least 100 hours in the Physical Laboratory, has attended at least 50 Lectures on **Physics,** and has passed the Class Examinations in this subject at a recognised Institution.

(*c*) That he has attended Lectures on **Elementary Mathematics** and has passed the Class Examinations in this subject at a recognised Institution. The Lectures and Examinations must include: Euclid, Books I., II., and III.; Algebra to Quadratic Equations, Ratio and Proportion; Plane Trigonometry to Solution of Triangles, Heights and Distances, Area of a Triangle, and Use of Logarithms.

A certificate of having satisfactorily passed an approved Examination in Mathematics covering the work indicated above will be accepted by the Council in lieu of evidence of a course in this subject having been taken.

(*d*) That he has also attended a course of instruction and passed the Class Examinations in **one optional subject** selected by himself from the following list, viz.:—

(i) Mathematics:—Trigonometry, Differential and Integral Calculus.

(ii) Elementary Mechanics, Steam, and General Chemical Engineering:—Properties of Constructive Materials:—Timber, Iron, Steel, Masonry. Principles of Construction of Boilers, Steam Engines, Gas Engines, Water-Wheels, Turbines, Pumping Engines and Pumps. Dynamo Machines, and Secondary Batteries. Furnaces. (40 to 50 Lectures, or an equivalent amount of instruction.)

(iii) Metallurgy:—Furnace Materials and Construction: Fuel (solid, liquid and gaseous), Mechanical Stokers, Pyrometers, Calorimeters, Manufacture and Properties of Iron and Steel. Manufacture of any two other Metals, and their properties. Assay of the metals chosen to be learnt practically. (40 to 50 Lectures, or an equivalent amount of instruction.)

(iv) Geology and Mineralogy :—About 40 to 50 Lectures or an equivalent amount of other instruction, with sufficient field or laboratory work once a week for a year, on general Physical and Stratigraphical Geology, Mineralogy, Petrography, and Economic Geology, with special reference to coal-fields, ore deposits, water supply, and drainage.

(v) Elementary Physiology :—General Biology of Plants and Animals, illustrated by reference to the Structure and Life History of selected types. Histology of Simple Tissues. Composition of Human Food and its Digestion. Circulation of the Blood, Respiration, Secretion and Excretion, Animal Heat. The Functions of the Nervous System. (40 to 50 Lectures or an equivalent amount of instruction, with practical work on the qualitative and quantitative Examination of blood, urine, bile, and milk.)

(vi) Bacteriology :—The use of the Microscope. The Morphology and Physiology of Micro-organisms. Forty to fifty lectures, or an equivalent amount of instruction, with practical work, to include the recognition of microscopic specimens, with systematic instruction and practice in the preparation, staining, mounting and drawing of specimens, as well as the preparation and study of pure cultures.

B.

(*a*) That during at least *two academic years* he has regularly attended systematic day courses in each of the following subjects, at one or more of the Institutions recognised by the Council (p. 44), and has passed the Class Examinations :—

Theoretical Chemistry, including the ordinary day courses of Lectures on Inorganic and Organic Chemistry given by the Professor ;

Practical Chemistry, including systematic Laboratory Work, three days in each week, and at least five hours each day ;

Physics (as on p. 10) ;

Elementary Mathematics (as (*c*) on p. 10) ; and

One Optional Subject, selected from the list (*d*) above ; and

(*b*) That he has also been systematically engaged in the study and practice of Analytical Chemistry for *two other years* under the direction of a Fellow of the Institute in a Laboratory approved by the Council.

6.—REGULATIONS FOR THE INTERMEDIATE EXAMINATION IN THEORETICAL AND PRACTICAL CHEMISTRY.

1. Candidates who have complied with the conditions of Clauses 1, 2, 3 and 4 of Section 5 are eligible for admission to the Intermediate Examination. Forms of application can be obtained from the Registrar.

2. Candidates who have obtained the Pass Degree of Bachelor of Science in a recognised University, and have complied with Clauses 1 and 2 of Section 5, are also eligible for admission to the Intermediate Examination, provided they produce evidence, satisfactory to the Council, that they have passed the Final or Degree Examination in Theoretical and Practical Inorganic and Organic Chemistry and Theoretical and Practical Physics, and that they have passed an Intermediate or Final University Examination in Mathematics covering the work set forth in paragraph (*c*) on p. 10.

3. On or before the date fixed for the closing of the List for each Intermediate Examination, every Candidate desirous of presenting himself is required to forward :—

(*a*) The form of application duly filled in and accompanied by certificates containing evidence that the Candidate is entitled to present himself for Examination in accordance with the Regulations.

(*b*) The Examination Fee : Five Guineas (£5 5*s.*)

(*c*) Note-books containing records of the practical chemical work of all kinds performed during training, the genuineness of the records to be attested by himself and his professors or teachers, according to the note-book form which may be obtained on application to the Registrar. The note-books will be submitted to the Examiners, who will take their contents into consideration and will have power to submit any Candidate to a *vivâ voce* examination upon them.

SYLLABUS OF THE INTERMEDIATE EXAMINATION.

The Intermediate Examination occupies at least four days, from 10 *a.m. to* 4.30 *p.m. on each day.*

The Examiners are at liberty to put questions to Candidates at any time during the examination.

The Examination consists of :—

(A) An Examination in General Theoretical Chemistry.

Candidates are required to show a thorough acquaintance with the fundamental laws of chemistry ; with the methods of preparation of the more important elements, and their compounds both inorganic and organic ; with the principles of chemical classification ; and with the current theories of chemical science. At least two papers, including questions in both Inorganic and Organic Chemistry, will be set.

(B) An Examination in Practical Chemistry.

This Examination is partly qualitative and partly quantitative :

QUALITATIVE.

1. Exercises in qualitative analysis : such as the analysis of artificial mixtures of moderate complexity, of alloys, and of ores, and the detection of specified substances present in minute quantities, or as impurities, in commercial products.

2. Preparation of substances, so chosen as to elicit evidence of the Candidate's acquaintance with ordinary chemical operations, such as crystallisation, solution, distillation, &c.

3. The recognition, by practical tests, of familiar typical inorganic and organic compounds.

4. The examination of gases, and the detection of one or more of the following in a gaseous mixture: hydrogen, chlorine, hydrogen chloride, hydrogen sulphide, oxygen, ozone, carbon monoxide, carbon dioxide, sulphur dioxide, nitrogen, ammonia, nitric oxide, methane, ethylene, and acetylene.

5. The use of the spectroscope: recognition and diagrammatic plotting of spectra.

6. The use of the microscope: preparation, mounting and measurement of specimens.

QUANTITATIVE.

1. The gravimetric and volumetric estimation of commonly occurring substances.

2. The determination of carbon and hydrogen, nitrogen, sulphur, or halogens, in organic compounds.

3. The volumetric determination of one or more of the constituents in a mixture which may contain hydrogen, oxygen, carbon monoxide, carbon dioxide, nitrogen, methane, and ethylene.

4. Determination of boiling point, melting point, relative density, or solubility.

5. The use of the calorimeter and the polarimeter.

The examination in quantitative analysis may include the performance of some operation selected from the Candidate's own record.

In doing combustions, Candidates are required to prepare their own combustion tubes and drying tubes.

During the Practical Examinations Candidates are at liberty to consult any books of reference which they may bring with them, or which are contained in the Library of the Institute.

7.—REGULATIONS FOR THE FINAL EXAMINATION FOR THE ASSOCIATESHIP (A.I.C.).

1. Candidates who have passed the Intermediate Examination of the Institute are eligible for admission to the Final Examination.

2. Candidates who have passed any of the following Examinations are exempted from the Intermediate Examination provided they produce evidence, satisfactory to the Council, of having been trained in Theoretical and Practical Chemistry, in Theoretical and Practical Physics, and in one optional scientific subject, in one or more of the Institutions recognised by the Council, in accordance with the Regulations of the Institute (pp. 9-11.):

ABERDEEN: The University.

The Final Examination for the Degree of B.Sc., with Special Distinction in Chemistry.

BIRMINGHAM: The University.

The Final Examination for the Degree of B.Sc. in the subjects of Chemistry and Physics, the Candidate's name being placed in either of the first two Divisions, with Chemistry as his principal subject, including Theoretical and Practical Inorganic and Organic Chemistry.

CAMBRIDGE: The University.

A First or Second Class in Part II. of the Natural Sciences Tripos, with Chemistry as the principal subject.*

DUBLIN: The University (Trinity College).

The Senior Moderatorship in Experimental Science.

The Royal University of Ireland.

The Final Examination for the Degree of B.A., with the Final Examination for B.Sc. or M.A. (involving Inorganic and Organic Chemistry).

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* A lower Class in Part II. may be accepted if the Candidate passed the Examination prior to 1st October, 1902.

FINAL EXAMINATION.

DUBLIN (*continued*)—

Royal College of Science.†

The Examination for the Associateship (Assoc. R.C.Sc., Dublin) in the Faculty of Manufactures, passed prior to 1st October, 1902, together with a Certificate from the Professor of Chemistry in the R.C.Sc., Dublin, or in some other University or College recognised by the Institute, that the Candidate has spent an additional period of six months exclusively in the Chemical Laboratory of such College.

DURHAM: The University.

The Final Examination for the Degree of B.Sc. in the subjects of Chemistry and Physics, with distinction in Chemistry as chief subject, including Theoretical and Practical Inorganic and Organic Chemistry.

EDINBURGH: The University.

The Final Examination for the Degree of B.Sc., with Special Distinction in Chemistry.

GLASGOW: The University.

The Final Examination for the Degree of B.Sc., with Special Distinction in Chemistry.

LONDON: The University.

The Final Examination for the Degree of B.Sc., with First or Second Class Honours in Chemistry.*

City and Guilds of London Central Institute.†

The Examination for the Associateship (A.C.G.I.) in the Department of Chemistry, if passed prior to 1st October, 1902.

Royal College of Science.†

The Examination for the Associateship (Assoc. R.C.Sc., London) in the Division of Chemistry, if passed prior to 1st October, 1902.

A.R.S.M.—Special Regulation.

Associates of the Royal School of Mines in Metallurgy, who have passed an approved Preliminary Examination, and have, since obtaining the Diploma, been systematically trained in Chemistry, for six months, in the Laboratories of an Institution recognised by the Council, are accepted as eligible for election to the Associateship of the Institute, on passing a Final Examination in General, Theoretical and Practical Chemistry.

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* A lower Class in Honours may be accepted if the Candidate passed the Examination prior to 1st October, 1902.

† Candidates who have passed the Examination for one of the following diplomas after 1st October, 1902, and also an Approved Preliminary Examination may claim exemption from the Intermediate Examination provided they produce evidence, satisfactory to the Council, of having been trained in Theoretical and Practical Chemistry, in Theoretical and Practical

FINAL EXAMINATION.

OXFORD: THE UNIVERSITY.
A First or Second Class in the Final Honour School of Natural Science in the subject of Chemistry.*

ST. ANDREW'S: THE UNIVERSITY.
The Final Examination for the Degree of B.Sc., with Special Distinction in Chemistry.

THE VICTORIA UNIVERSITY.
The Final Examination for the Degree of B.Sc., with First or Second Class Honours in Chemistry.*

THE UNIVERSITY OF WALES.
The Final Examination for the Degree of B.Sc., with First or Second Class Honours in Chemistry.*

No Candidate for the Associateship will, under any circumstances, be exempted from passing a Final Examination.

Candidates may forward, for the inspection of the Examiners, note-books containing duly authenticated records of practical chemical work of an advanced character done by them since passing the Intermediate Examination, or not previously inspected, and the contents will be taken into consideration in deciding the Examination.

The Examination Fee must be paid at the time of making application for admission to this Examination. The Fee is Five Guineas (£5 5s.) for Candidates who have passed the Intermediate, and Ten Guineas (£10 10s.) for Candidates exempted from passing the Intermediate Examination.

Physics, and in one optional scientific subject, in accordance with the Regulations of the Institute:

The Associateship of the City and Guilds of London Central Institute (A.C.G.I.), in the Department of Chemistry; the Associateship in the Royal College of Science (Assoc. R.C.Sc.), London, in the Division of Chemistry; and the Associateship of the Royal College of Science, Dublin (Assoc. R.C.Sc.I.), in the Faculty of Applied Chemistry, together with a Certificate from the Professor of Chemistry in the R.C.Sc., Dublin, or in some other University of College recognised by the Institute, that the Candidate has spent an additional period of six months exclusively in the Chemical Laboratory of such College.

NOTE.—The Regulation requiring Associates of the Royal Colleges of Science (London and Dublin) and Associates of the City and Guilds of London Institute to pass an approved Preliminary Examination, will not be enforced in the cases of those who produce evidence, satisfactory to the Council, that they entered on a systematic course of training in Chemistry at a recognised College prior to 1st July, 1902.

SYLLABUS OF THE FINAL EXAMINATION.

The Final Examination occupies at least four days, from 10 a.m. to 4.30 p.m. on each day; Branch (e) at least five days.

In cases where Candidates for the Final Examination have been exempted from passing the Intermediate Examination, the Examiners are empowered, if they deem such a course advisable, to extend the period of Examination in order to test the general knowledge of Chemistry possessed by such Candidates.

The Examiners are at liberty to apply any test which they think desirable either vivâ voce, or by writing, or by experimental work, in order to obtain evidence as to the knowledge of Theoretical and Practical Chemistry possessed by the Candidate.

1. Each Candidate for the Final Examination is required to show, in addition to a general knowledge of all branches of Chemistry, a *thorough* acquaintance with at least one of the following branches, to be selected by himself :—

(*a*) **Mineral Chemistry:** including General Inorganic Qualitative and Quantitative Analysis, and the preparation of pure Inorganic Substances.

(*b*) **Metallurgical Chemistry:** including the Analysis and Assay of Metals, Ores, Fuel, Metallurgical Products, and Materials used in Metallurgical Processes.

(*c*) **Physical Chemistry**: Candidates are expected to show special theoretical and practical knowledge of the Methods, Instruments and Apparatus employed in Physico-chemical Processes and Investigations.

(*d*) **Organic Chemistry:** including Ultimate Organic Analysis and the estimation of the Proximate Constituents of Organic Mixtures. The Preparation and detailed investigation of Organic Compounds.

*(*e*) **Analysis of Food and Drugs and of Water:** including the Examination and Analysis of any food or drug within

the meaning of the Sale of Food and Drugs Acts ; the Assay of Alkaloids ; the recognition of Poisonous Chemicals and Crude Drugs ordinarily found in commerce and having well-marked physical characters ; the use of the Microscope in the detection of adulterations, substitutions, commonly occurring parasites, and impurities in Food, Drugs, and Water.

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* Candidates desirous of becoming qualified as Public Analysts should take Section (*e*) in the Final Examination.

Candidates in Section (*e*) are required to show a general knowledge of the Therapeutic Effects of Chemicals and Drugs, and of the quantities which, taken internally, would be injurious or fatal to man.

*(*f*) **Biological Chemistry:** with special reference to Fermentation, Enzyme-action, the Chemistry and Bacteriology of Food-Stuffs, Water Supply, and Sewage Disposal, and to the application of Biological Chemistry to Industries and Manufactures.

During the Practical Examinations Candidates are at liberty to consult books of reference, but not during any part of the Examination conducted by the Examiner in Therapeutics, Pharmacology and Microscopy, in Branch (*e*).

2. Any Candidate is at liberty to present a thesis or dissertation upon any Chemical subject to which he has given special attention, and the Examiners will take it into account in deciding the Examination. The thesis must be forwarded not less than fourteen days prior to the first day of the Examination, and must be accompanied by evidence as to whether the work has been carried out entirely by the Candidate, or conjointly with his professor, or with another student.

3. All Candidates must be familiar with the use of such scientific instruments as are commonly used in Chemical Laboratories.

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* Candidates intending to enter for the Final Examination in Branch (*f*), viz., Biological Chemistry, are recommended to take (after passing the Intermediate Examination, or any Examination qualifying for admission to the Final) the course of study mentioned on p. 21.

8.—THE FELLOWSHIP (F.I.C.).

1. Every Associate applying for admission to the Fellowship is required to produce evidence :—

(*a*) That he is not less than 24 years of age.

(*b*) That he has since his admission as an Associate, and for a period of three years therefrom been continuously engaged in the study and practice of applied Chemistry in a manner that shall be satisfactory to the Council.

2. Applications must be made to the Council, and must be accompanied by a letter signed by some responsible person, preferably a Fellow of the Institute, testifying that the Candidate has fulfilled the foregoing conditions.

3. The Entrance Fee payable on election to the Fellowship is Five Guineas. No name can be transferred from the Associates' to the Fellows' List until this fee has been paid.

4. In exceptional cases non-Associates may be elected to the Fellowship. Every such Candidate is required to produce evidence of age, and a satisfactory certificate of moral character, He must also give full information as to his general and scientific education and professional career. It rests with the Council to determine in each case whether a Candidate applying for the Fellowship shall be exempted from passing any Examination, or shall be required to pass either the Intermediate or Final Examination or both. If examination be imposed, or if the Candidate be exempted from passing any examination, the Examination Fee (£15 15*s*.) must be paid, in addition to the Entrance Fee (£5 5*s*.). If the Candidate be required to pass both the Intermediate and Final Examinations he shall pay £5 5*s*. for the Intermediate, and £10 10*s*. for the Final Examination.

9.—EXAMINATION IN BIOLOGICAL CHEMISTRY.

In view of the increasing application of biological methods to investigations connected with water supplies and sewage treatment, the Council consider it desirable to encourage analytical chemists in the study of Bacteriology and Biological chemistry.

Accordingly, the Council have resolved that Fellows and Associates of the Institute who desire to obtain a certificate of competency in this branch of work shall be allowed to take the Examination in Biological Chemistry. (See Branch (*f*) on page 18.)

While suited to those intending to practise their profession in its relation to the chemistry and bacteriology of water, sewage and effluents, the Examination is also suited to those who are interested in the chemistry of Brewing and other industries involving both chemical and biological knowledge.

For Fellows and Associates the fee for this Examination is £5 5s.

Candidates intending to enter for the Examination in Biological Chemistry are recommended to study the following subjects:—

1. Elementary Biology.

2. The Morphology, Physiology, and Life History of Bacteria, Yeasts and Moulds, in their relation to Food, Water Supply, the Treatment of Sewage, Agriculture, and the Fermentation Industries. (A *special* study of pathogenic organisms is not demanded, but the candidate should acquire a knowledge of such as are of importance in relation to Food and to Water Supply). Practical work should include :—(*a*) General bacteriological methods and preparation of pure cultures; (*b*) Microscopy: the staining and mounting of preparations, and the recognition of species; (*c*) Fermentation changes caused by micro-organisms.

3. Enzymes and their actions.

4. The methods employed in the examination and estimation of the carbo-hydrates.

5. The Proteids and their decomposition products.

10.—QUALIFICATIONS FOR PUBLIC ANALYSTS, UNDER THE SALE OF FOOD AND DRUGS ACTS.

It is open to any Fellow or Associate of the Institute who can produce evidence satisfactory to the Council that he has been continuously and systematically engaged, for at least one year in the Analysis of Food and Drugs in the Laboratory of a Fellow of the Institute engaged in such practice, to take the Examination in the Analysis of Food and Drugs and of Water. (See Branch (*e*) of the Final Examination on p. 18.) Fellows and Associates who pass this Examination will be granted a Certificate in Therapeutics, Pharmacology and Microscopy.

The possession of the diploma of Fellowship or Associateship of the Institute of Chemistry, together with the Certificate granted on passing this Examination, is accepted by the Local Government Board for England and Wales, and the Local Government Boards for Scotland and Ireland, as evidence that the holder is fully qualified for the office of Public Analyst under the Sale of Food and Drugs Acts.

The Fee for this Examination is Five Guineas (£5 5*s*.).

11.—EXAMINATION FOR TECHNICAL CHEMISTS.

1. The Council have resolved to hold Examinations in the industrial applications of Chemistry and to grant Certificates in respect thereof.

2. These examinations will be open only to Fellows, and to those Associates who have been registered as such for at least one year.

3. Candidates will be required to produce evidence of practical technical training.

4. The Examinations will comprise the following:—

(*a*) The application of well-known chemical and physical laws to industrial operations.

(*b*) The development, control, and transmission of power and heat.

(*c*) A working knowledge of operations and plant, of which general use is made in industrial works for the treatment and handling of materials, finished products, waste products and effluents, including a practical acquaintance with fittings and stores.

(*d*) The properties of materials affecting their application to the construction of plant and apparatus in chemical works.

(*e*) Some ability in interpreting drawings of chemical plant and in making dimensioned rough sketches.

(*f*) The calculation of working costs, and a general knowledge of the clerical work connected with manufacturing operations.

5. Each Candidate will be required to select one important industry, in which his knowledge of the above subjects may be tested. Questions which might involve the disclosure of unpublished processes and details of plant in particular works will not be asked. All Candidates will be expected to give evidence of a general knowledge of chemical technology. The Examiners will take into account original work and special knowledge, but not so as to excuse the Candidate from any part of the Examination.

An Advisory Committee has been appointed to decide the arrangements to be made for the conduct of these Examinations, and the form they shall take. The first Examinations under this scheme will be held in 1906.

12.—GENERAL INSTRUCTIONS TO CANDIDATES FOR EXAMINATION.

1. The Intermediate and Final Examinations are held each year in January, April and July, except the Final Examination in Biological Chemistry which is held in October.

If, at the date of closing the list of candidates for an Examination, less than 35 have entered their names, the places will be allotted to the first 25 Candidates whose applications and fees are received. If there are more than 35 Candidates, a second examination will be held in the following week, but no examination period will extend over more than two weeks, and the Council cannot undertake to admit more than 25 Candidates in each week. Any remaining Candidates may be admitted to a subsequent Examination.

2. Forms of Application for admission to Examination, which may be obtained from the Registrar, must be filled up and forwarded to the Office of the Institute and must be accompanied by the enclosures mentioned in these Regulations and referred to in the forms.

3. No name will be placed on the list of Candidates for Examination unless the application, the note-books, note-book forms, and fee of the Candidate have been received at the Office of the Institute on or before the date fixed for the closing of the list.

4. Due notice of Examination will be given to each Candidate whose application has been accepted by the Council; but no notice will be forwarded to any Candidate who has not presented himself for Examination within a period of two years from the date of the acceptance of his application, or of his failure at an Examination.

5. The dates of the Examinations will be published in daily newspapers and scientific journals.

6. Candidates who have previously entered for Examination are not required to fill in new forms of application.

The list of names of successful Candidates will be sent, as soon as copies are available, to every Candidate and to every University, College, or School recognised by the Council, from which any Candidate has proceeded to the Examination. It will also be circulated among the leading newspapers of the United Kingdom.

Unsuccessful Candidates will be informed of the subjects in which they have failed, as soon as possible after the publication of the Pass List.

13.—LIST OF FEES.

No application for the Fellowship, Studentship, or for admission to the Examinations, will be considered by the Council unless it be accompanied by the Fee payable according to the following schedule. If the application be declined the Fee will be returned.

STUDENTSHIP.	£	s.	d.
Registration Fee	0	5	0
EXAMINATIONS.*			
Intermediate: For each entry	5	5	0
Final: Candidates who have passed the Intermediate: For each entry	5	5	0
Candidates exempted from passing the Intermediate: For the first entry	10	10	0
For each subsequent entry	5	5	0
Examination in the Analysis of Food and Drugs, &c., for the certificate in Therapeutics, Pharmacology and Microscopy: For Fellows and Associates, each entry	5	5	0
Examination in Biological Chemistry: For Fellows and Associates, each entry	5	5	0
Examination for the Fellowship: For one Examination (For Intermediate £5 5s., and Final £10 10s.)	15	15	0
For each subsequent entry (each Examination)	5	5	0

When a Candidate who has signified his intention of presenting himself for an Examination withdraws his name, or fails to present himself at the Examination, the fee paid by him will not be returned, and it will rest with the Council to decide what fee, if any, he shall pay for a subsequent entry.

ENTRANCE TO THE FELLOWSHIP.

	£	s.	d.
Associates elected as such prior to 1st January, 1898	5	5	0
Associates elected as such after 1st January, 1898:—			
(*a*) If elected Fellows prior to 31st December, 1905	4	4	0
(*b*) If elected Fellows after 31st December, 1905	5	5	0

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* Candidates registered or accepted for Examination prior to the 1st of January, 1904, will be charged the fees now in force, for any Examination held after the 1st of January, 1907.

FEES.

	£	s.	d.
Candidates elected to the Fellowship after Examination	£5	5	0
Candidates (not previously Associates) elected to the Fellowship without Examination are required to pay the amount of the Fee for Examination for the Fellowship (£15 15*s*.), in addition to the Entrance Fee (£5 5*s*.) and Annual Subscription (£1 1*s*.)	22	1	0

LIFE COMPOSITION FEES IN LIEU OF ANNUAL SUBSCRIPTION.

(*a*) Fellows elected prior to the granting of the Charter (June 1885), have the choice of compounding at £12 12*s*., or at the amount prescribed below according to age ;

(*b*) Fellows elected prior to January 1st, 1902, and Associates elected Fellows prior to December 31st, 1905, have the choice of compounding at £16 16*s*., or at the amount prescribed below according to age ;

(*c*) Non-Associates elected Fellows after January 1st, 1902, and Fellows elected after December 31st, 1905, have the choice of compounding at £21, or at the amount prescribed below according to age;

Between the ages of	£	*s*.	*d*.
50 and 52	12	12	0
52 ,, 54	11	11	0
54 ,, 56	10	10	0
56 ,, 58	9	9	0
58 ,, 60	8	8	0
60 ,, 62	7	7	0
62 ,, 64	6	6	0
64 ,, over	5	5	0

⁂ Cheques and Post Office Orders (payable at the General Post Office) should be drawn to the order of the Institute of Chemistry, and crossed "London and Westminster Bank a/c The Institute of Chemistry."

EXAMINATION PAPERS, 1904-1905.

Intermediate and Final (A.I.C.) Examinations:

JULY, 1904.

Examiners in Chemistry:
Walter William Fisher, M.A. (Oxon.), F.I.C.
George Gerald Henderson, M.A., D.Sc. (Glasgow), F.I.C.

Examiner in Therapeutics, Pharmacology and Microscopy:
Arthur Pearson Luff, M.D., B.Sc. (Lond.), F.R.C P., F.I.C.

Intermediate Examination.

July 5th to 8th, 1904.

GENERAL AND THEORETICAL CHEMISTRY.

TUESDAY, JULY 5th, 1904: 10 *a.m. to* 1 *p.m.*

Not more than *four* of the following questions are to be attempted:—

1. How is hydrogen peroxide prepared, and what are its properties? Describe the tests for this compound, and indicate its uses in the laboratory and in industries.

2. Describe and give examples of the methods of preparing primary monamines of the fatty and the aromatic series. By what reactions can primary, secondary and tertiary amines be distinguished?

3. What is a reversible reaction? Give examples, and state the general conclusions which have been arrived at by the investigation of reversible reactions.

4. Describe the methods of preparation and the properties of the halogen compounds of platinum. How are spongy platinum and platinum black prepared, and for what purposes are these forms of the metal used?

5. How would you proceed to prepare ethyl acetoacetate? Give as many instances as you can of the use of this substance in the synthesis of other organic compounds.

6. Indicate the reactions by which hydroxylamine can be obtained, and describe the usual method of preparing hydroxylamine salts. Give an account of the properties of hydroxylamine and of its value as a reagent.

2 *p.m. to* 5 *p.m.*

Not more than *four* of the following questions are to be attempted :—

1. How is quinoline prepared, what are its properties, and for what purposes is it used? Give the constitutional formula of quinoline and explain in detail how it has been established.

2. State what you know of the processes which have been proposed for the fixation of atmospheric nitrogen, particularly any which are at present in operation.

3. Describe fully the cryoscopic method of determining molecular weights. In what circumstances are abnormal results obtained, and how can those results be accounted for?

4. From what sources and by what methods is glycerol manufactured? How would you proceed to prepare (*a*) formic acid (*b*) acraldehyde and (*c*) allyl alcohol from glycerol?

5. State as fully as you can the chemical resemblances between the corresponding compounds of (*a*) chromium and sulphur and (*b*) chromium and iron.

6. What is the meaning of the term "condensation"? Describe any reactions of this type known to you in which (*a*) benzaldehyde and (*b*) phthalic anhydride take part, indicating in each case the conditions under which the reaction occurs.

PRACTICAL CHEMISTRY.

WEDNESDAY, JULY 6th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. The liquid A is an aqueous solution of sodium and potassium chlorides. Determine the quantity of each salt contained in one litre of the solution.

2. Identify the substance B, and determine its physical constants. (Methyl Oxalate.)

THURSDAY, JULY 7th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Determine by a volumetric method the percentage of sodium sulphide in the solution A.

2. Ascertain the proximate constituents of the mixture B, which contains three compounds. (Stannic oxide, calcium oxalate, and glucose ; silica, calcium phosphate, and urea ; barium sulphate, aluminium phosphate, and cane sugar ; *one* mixture to each candidate.)

FRIDAY, JULY 8th, 1904 : 10 *a.m. to* 4.30 *p.m.*

Make a complete qualitative analysis of the given ore (Zinc blende), and determine the percentage of two of its chief constituents.

Final Examinations for the Associateship.

Branch "A."—Mineral Chemistry.

TUESDAY, JULY 12th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Determine the proportion of metallic chromium in the commercial sample of metal A. What other elements are present ?

2. Identify the mineral B. (Cryolite).

WEDNESDAY, JULY 13th, 1904 : 10 *a.m. to* 4.30 *p.m.*

The solution contains sulphurous and sulphuric acids : find the proportion of each in one litre.

Make the solution approximately decinormal for the sulphurous acid and find the quantity evolved as hydrogen sulphide when definite amounts are brought into an apparatus in which hydrogen is being generated by the action of zinc on hydrochloric acid.

THURSDAY, JULY 14th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Find the constituents of the polishing powder and determine the amount of two ingredients.

2. Determine the strength of the solution of hydrogen peroxide by two methods, one being a gasometric determination.

FRIDAY, JULY 15th, 1904 : 10 *a.m. to* 4.30 *p.m.*

Identify the mineral D. (Molybdenite.)

Determine the percentage of the chief non-metallic constituent and prepare a specimen of metallic oxide.

Branch "B."—Metallurgical Chemistry.

TUESDAY, JULY 5th, 1904 : 9.45 *a.m. to* 4.30 *p.m.; and*
WEDNESDAY, JULY 6th, 1904 : 10 *a.m. to* 4.30 *p.m.*
(At the Royal College of Science, London).

1. Determine the amounts of gold and silver in the sample of copper, and return the results of your assays in ounces per ton.

2. Determine the percentages of copper and nickel in the copper-nickel alloy. The determinations to be made electrolytically.

(*Two days were allowed for these analyses*).

THURSDAY and FRIDAY, JULY 7th and 8th, 1904:
10 *a.m. to* 4.30 *p.m. on each day.*
(At the Institute).

3. Determine the percentage of iron in the sample of chromite.

4. Make an examination of the sample of dolomite and report as to its suitability for use as a material for the bottom of a basic open-hearth steel furnace. The percentages of CaO and CO_2 need not be determined.

(*Two days were allowed for these analyses*).

Branch "C."—Physical Chemistry.

TUESDAY, JULY 12th, 1904 : 10 *a.m. to* 4.30 *p.m.*

Investigate the relative accelerating influences of formic, oxalic and succinic acids on the inversion of cane sugar.

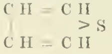
In the case of any one of these acids study the relation between the velocity of the hydrolysis of the cane sugar and the concentration of the acid.

WEDNESDAY, JULY 13th, 1904 : 10 *a.m. to* 4.30 *p.m.*

Investigate the action of iodine on potassium ferrocyanide with a view to determining the velocity of the reaction. Study the influence of extra added potassium ferricyanide on the reaction and from your results draw conclusions as to the nature and extent of the reversible reaction.

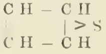
THURSDAY, JULY 14th, 1904 : 10 *a.m. to* 4.30 *p.m.*

The liquid A is thiophene. Make as complete a study of its physical properties as you can in the time at your disposal, paying special attention to determinations of its vapour density, molecular elevation constant, specific volume and refractive index. From the results which you obtain for the two last constants and from accepted data for atomic volumes and atomic refractive energies compare the probable values of the two formulæ.



$$\begin{array}{l} CH = CH \\ | \qquad\quad > S \\ CH = CH \end{array}$$

and



$$\begin{array}{l} CH - CH \\ \qquad\quad | > S \\ CH - CH \end{array}$$

FRIDAY, JULY 15th, 1904: 10 *a.m. to* 4.30 *p.m.*

Identify the mineral D. (Molybdenite).

Determine the percentage of the chief non-metallic constituent and prepare a specimen of metallic oxide.

Branch "D."—Organic Chemistry.

TUESDAY, JULY 12th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. The liquid A is impure benzene (Benzene containing toluene and a trace of thiophen). Identify the impurities, and then purify the benzene and determine its molecular refraction.

2. Examine qualitatively the mixture B. (Quinine sulphate and zinc lactate; morphine acetate and bismuth valerianate; strychnine sulphate and calcium citrate; *one* mixture to each candidate).

WEDNESDAY, JULY 13th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. Identify the Substance A and determine its molecular weight by the boiling point method. (Ethyl succinate).

2. Examine the dyestuff B and report on its nature. (Chrysoïdine).

THURSDAY, JULY 14th, 1904: 10 *a.m. to* 4.30 *p.m.*

Determine the percentage of methoxyl in the given substance. (Anisic acid). Leave on your bench specimens of any derivatives which you can prepare from the substance.

FRIDAY, JULY 15th, 1904: 10 *a.m. to* 4.30 *p.m.*

Determine by Kjeldahl's process the percentage of nitrogen in the given substance (Sodium benzoic sulphinide). Ascertain as fully as possible the constitution of the substance. Leave on your bench specimens of any derivatives obtained in the course of your investigation.

Branch "E."—The Analysis of Food and Drugs, and of Water.

TUESDAY, JULY 12th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. Determine the moisture, nitrogen, and ash of the yeast, and report on the purity of the sample.

2. Identify the two drugs supplied (Lithium salicylate, sulphonal, quinine arsenate; *two* to each Candidate).

WEDNESDAY, JULY 13th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. Ascertain the proportion of total residue, "ethers," volatile and fixed acids, and the alcoholic strength of the brandy, and give an opinion of its character.

2. Examine the sample of sausage.

THURSDAY, JULY 14th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. Report on the sample of olive oil: separate the fatty acids and determine their saponification value.

2. Ascertain the composition of the given mixture and determine the proportion of any poison found (Cane sugar and lead chromate, oatmeal and "white precipitate powder," calcined magnesia and potassium binoxalate; *one* mixture to each Candidate).

FRIDAY, JULY 15th, 1904: 10 *a.m. to* 4.30 *p.m.*

1. Make a qualitative examination of the sample of water A: determine the total solids, chlorides, nitrates and hardness. Give an opinion of its quality.

2. Ascertain the amount of lead in the sample B.

Candidates in Branch "E" of the Final Examination were required to pass an Examination in Therapeutics, Pharmacology, and Microscopy.

SATURDAY, JULY 16th, 1904: 10 *a.m. to* 1 *p.m.*

1. Examine the specimen of coffee marked A and report on its probable purity or otherwise, basing your opinion on the microscopical appearances only. Leave a prepared slide on your bench.

2. Examine the specimen of flour marked B, and report on its probable purity or otherwise, basing your opinion on the microscopical appearances only. Leave a prepared slide on your bench.

3. Examine, describe and state respectively the nature of the prepared slides marked C and D.

4. Under what conditions may articles of food become poisonous? Describe the nature of the poisons that may respectively be present, and the symptoms produced by each.

5. Give the full medicinal and the average fatal doses for an adult of the following substances:—Strychnine, zinc sulphate, atropine, tartar emetic, arsenious oxide, corrosive sublimate, cocaine.

Candidates in this Branch were also examined practically and interrogated orally as to the recognition of Chemicals and Drugs.

Examination in Biological Chemistry,

October 25th to 28th, 1904.

Examiner :

Professor Adrian J. Brown, M.Sc. (Birm.), F.I.C.

TUESDAY, OCTOBER 25th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Investigate the nature of the micro-organisms existing on the given sample of water-cress, and examine specially for the presence of sewage bacteria.

(Note.—This exercise is to be continued throughout the examination, but you must give in your note-book, to-day, a brief general account of what you propose to do to complete the exercise.)

WEDNESDAY, OCTOBER 26th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Examine the given solution for the presence of albumin, globulin, albumose and peptone.

2. Prepare from the given sample of hemp seed a specimen of globulin (edestin).

THURSDAY, OCTOBER 27th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Examine the given solution for the presence of proteolytic, rennetic and amylolytic enzymes.

2. Determine by Lintner's method the diastatic (amylolitic) power of the two given samples of malt.

FRIDAY, OCTOBER 28th, 1904 : 10 *a.m. to* 4.30 *p.m.*

1. Determine the amount of dextrose and of cane-sugar in the given solution.

2. Complete as far as possible the investigation commenced on the first day and write a critical report on the results so far obtained.

Intermediate and Final (A.I.C.) Examinations:

JANUARY, 1905.

Examiners in Chemistry:

Walter William Fisher, M.A. (Oxon), F.I.C.

George Gerald Henderson, M.A., D.Sc. (Glasgow), F.I.C.

Examiner in Therapeutics, Pharmacology and Microscopy:

Arthur Pearson Luff, M.D., B.Sc. (Lond.), F.R.C.P., F.I.C.

Intermediate Examination.

GENERAL AND THEORETICAL CHEMISTRY.

TUESDAY, JANUARY 3rd, 1905*:* 10 *a.m. to* 1 *p.m.*

(Not more than *four* questions, of which 2 or 6 must be one, are to be answered.)

1. Describe the method by which magnesium is prepared, and compare the chemical character of the element with that of calcium and of zinc. Give as many examples as you can of the use of magnesium in the preparation of inorganic and organic substances.

2. From what natural source, and how, is indigo obtained? State the properties and uses of indigo, and trace the steps in the synthetic processes by which (*a*) cinnamic acid and (*b*) naphthalene can be converted into indigotin.

3. Give some examples of catalytic actions, explaining, if possible, the action of the catalyst in each case. Describe fully any catalytic actions known to you which are employed in manufactures.

4. Describe the modes of preparation, properties and reactions of the acids of boron, and indicate the methods by which the percentage of boric acid in a borate can be estimated.

5. Give an account of the compounds formed by the direct combination of carbon monoxide with other substances, and state the conditions under which each compound is obtained.

6. Describe and give examples of the principal methods of preparing hydroxy acids of both the fatty and the aromatic series. What are lactones, and how are they related to hydroxy acids?

2 *p.m. to* 5 *p.m.*

(Not more than *four* questions are to be answered.)

7. How are the chlorate and the perchlorate of potassium prepared? What is the action of hydrochloric acid and of sulphuric acid on each of these salts? What takes place when chlorine in excess is passed into (*a*) an aqueous solution of potassium iodide, and (*b*) water containing calcium carbonate in suspension?

8. Starting with aniline, how would you proceed to prepare (*a*) iodobenzene, (*b*) tribromophenol, (*c*) aminoazobenzene, and (*d*) phenylhydrazine?

9. By what methods can externally compensated substances be resolved into their optically active components? Describe fully one example of the application of each method.

10. Illustrate by examples the various purposes for which acetic anhydride, phenylhydrazine, and anhydrous zinc chloride are used in synthetical organic chemistry.

11. Describe any electrolytic processes known to you which are used on the manufacturing scale.

12. Define the terms acid and base. Describe the methods by which the relative strengths of bases can be determined, and give a general account of the results obtained.

PRACTICAL CHEMISTRY.

WEDNESDAY, JANUARY 4th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Examine qualitatively the aqueous solution A, and determine the percentage of the principal salt which it contains. (Silicate of soda).

2. Identify the substance B, and prepare from it as many pure compounds as you can. (Amyl formate).

THURSDAY, JANUARY 5th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Determine the quantity of ammonia and of chromic acid contained in one litre of the solution C. The chromic acid is to be estimated by a volumetric process. (Solution of ammonium bichromate).

2. Examine the mixture D with the spectroscope, and map the observed spectrum on squared paper. (Chlorides of potassium, strontium and lithium).

FRIDAY, JANUARY 6th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. The given solution contains the sodium salts of two organic acids. Identify the acids, prepare a specimen of each, and ascertain approximately the quantity of each salt contained in one litre of the solution. (Sodium benzoate and citrate).

2. Determine (*a*) the molecular weight of one of the acids by a chemical method, and (*b*) its solubility in water at 20° and at 100°.

Final Examinations for the Associateship.

Branch "A."—Mineral Chemistry.

TUESDAY, JANUARY 10th, 1905: 10 *a.m. to* 4.30 *p.m.*

Make an analysis of the Portland Cement.

Report on the amount of lime, after deduction of the quantity necessary for the formation of calcium sulphate.

(*The exercise may be completed to-morrow*).

WEDNESDAY, JANUARY 11th, 1905: 10 *a.m. to* 4.30 *p.m.*

Complete the analysis of the Cement.

THURSDAY, JANUARY 12th, 1905: 10 *a.m. to* 4.30 *p.m.*

Analyse the pigments A (Scheele's green), and B (Barium chromate, lead chromate and cadmium sulphide), and determine the amounts of the chief constituents in A.

FRIDAY, JANUARY 13th, 1905: 10 *a.m. to* 4.30 *p.m.*

Ascertain the ratio of Iodine to Chlorine in the substance C. (Iodine trichloride).

Analyse and identify the mineral D (Wolfram), and determine its specific gravity.

Leave on your bench any characteristic products obtained in the analysis.

No Candidate was Examined in Branch "B" (Metallurgical Chemistry) or in Branch "C" (Physical Chemistry).

Branch "D."—Organic Chemistry.

TUESDAY, JANUARY 10th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Estimate the percentage of sulphur in substance A (sulphanilic acid) by a method which does not involve the use of sealed tubes.

2. Identify the substance B (Œnanthol), and prepare from it as many derivatives as time will permit.

WEDNESDAY, JANUARY 11th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Prepare a specimen of pure acetone from the commercial sample supplied to you, and determine its vapour density by Meyer's method.

2. Ascertain the manner in which the nitrogen is combined in the substance C, and prepare from it specimens of related compounds containing nitrogen. (Succinimide).

THURSDAY, JANUARY 12th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Prove experimentally that the given substance is a dibasic hydroxy acid. (Malic Acid).

2. Heat a portion of the substance at 175-180° until about half has distilled over, and then investigate fully the nature of the products contained in the distillate and in the residue.

FRIDAY, JANUARY 13th, 1905: 10 *a.m. to* 4.30 *p.m.*

Investigate the given substance (Congo Red) as fully as possible with the view of ascertaining how it could be prepared. Leave specimens of any decomposition products obtained in the course of your work.

Branch "E."—The Analysis of Food and Drugs, and of Water.

TUESDAY, JANUARY 10th, 1905: 10 *a.m. to* 4.30 *p.m.*

Find the constituents of the mixture J (Morphia hydrobromide and ammonium bromide). Determine the proportions of alkaloid and halogen present in the mixture.

Examine the syrup and dried fruit for preservatives.

WEDNESDAY, JANUARY 11th, 1905: 10 *a.m. to* 4.30 *p.m.*

Make an analysis of the sample of Desiccated Milk.

State whether any substance has been added to the milk or any fat abstracted.

THURSDAY, JANUARY 12th, 1905: 10 *a.m. to* 4.30 *p.m.*

Report on the purity of the given drugs K (Bismuth subnitrate containing antimony oxide), L (Dialysed iron), and determine one constituent in each.

Find the proportion of formaldehyde in the given solution. (Formaldehyde and milk sugar).

FRIDAY, JANUARY 13th, 1905: 10 *a.m. to* 4.30 *p.m.*

Prepare a specimen of fatty acid from the given compound: determine its melting point and find its molecular weight by a chemical method. (Sodium stearate).

Report on the sample of "soda water" in the siphon supplied.

Candidates in Branch "E" of the Final Examinations were requiredto pass an Examination in Therapeutics, Pharmacology, and Microscopy.

MONDAY, JANUARY 9th, 1905: 1.30 *p.m. to* 4.30 *p.m.*

1. Examine the specimen of rhubarb marked A, and report on its probable purity or otherwise, basing your opinion on the microscopical appearances only. Leave a prepared slide on your bench.

2. Examine by means of the microscope the specimen marked B. Describe in detail its nature as seen under the microscope. Leave a prepared slide on your bench.

3. Examine, describe, and state respectively the nature of the prepared slides marked C and D.

4. What are the various metallic impurities that may be present in articles of food and drink? Describe the sources from which these impurities are derived, and the effects which they are liable to produce on the health of persons consuming such articles.

5. Give the full medicinal and the average fatal doses for an adult of the following substances:—Morphine acetate, sulphuric acid, phenazon, phosphorus, codeia.

Candidates in this Branch were examined practically and interrogated orally as to the recognition of Chemicals and Drugs.

Intermediate and Final (A.I.C.) Examinations:

APRIL, 1905.

Examiners in Chemistry:
WALTER WILLIAM FISHER, M.A. (Oxon.), F.I.C.
GEORGE GERALD HENDERSON, M.A., D.Sc. (Glasgow), F.I.C.

Examiner in Therapeutics, Pharmacology, and Microscopy:
FREDERICK GOWLAND HOPKINS, D.Sc., M.B. (Lond.),
M.A. (Cantab.), F.I.C.

Intermediate Examination.

GENERAL AND THEORETICAL CHEMISTRY.

TUESDAY, APRIL 4th, 1905: 10 *a.m.* to 1 *p.m.*

(Not more than *four* questions, of which 2 or 4 must be one, are to be answered.)

1. Describe the extraction of lead from galena, giving a full explanation of the reactions on which the process is based. How is the metal purified on the commercial scale? What is the action of water on lead, under what conditions does the action take place, and what is the effect of the presence of such substances as commonly occur in natural waters?

2. How is "nitroglycerine" manufactured? Give an account of the properties of this substance and of its various industrial applications. How would you propose to analyse a sample of nitroglycerine, and how could you demonstrate the constitution of the compound?

3. Give an exact description of the method of determining the electrical conductivity of a salt solution, and explain how the degree of dissociation of the salt may be deduced from the results of conductivity experiments.

4. From what sources, and in what manner, are the pyridine bases obtained? Describe the general chemical character of these substances, and state the grounds on which pyridine is held to be a cyclic compound. Name any alkaloids which are known to be derivatives of pyridine.

5. Describe any experiments on the rate of chemical change with which you are acquainted, and state any general conclusions which have been arrived at through the experimental investigation of this subject.

6. Indicate the methods by which the more important cuprous compounds can be obtained, and compare their properties with those of the corresponding compounds of silver. For what purposes are cuprous salts chiefly used?

2 *p.m.* to 5 *p.m.*

(Not more than *four* questions are to be answered.)

7. Describe the process of extracting anthracene from coal tar and purifying the crude product. What is the constitutional formula of anthracene, and how has it been established? Mention three derivatives of commercial importance, and explain their relationship to the hydrocarbon.

8. How would you proceed to prepare (*a*) a dilute aqueous solution of hydrocyanic acid, and (*b*) the anhydrous acid? Illustrate, by as many examples as you can give, the importance of hydrocyanic acid and of its metallic salts in synthetical organic chemistry.

9. Describe the methods in use for the preparation of the hyposulphites, thiosulphates, and persulphates of the alkali metals. State the characteristic properties of these salts, and give examples of their use in the laboratory and for manufacturing purposes.

10. Starting with ethyl alcohol and concentrated sulphuric acid, what substances could you obtain, and how would you proceed to prepare and purify them? Give a brief account of the chemical character of each of the products.

11. Mention the aqueous solutions which are in use for extracting gold from its ores, and explain the chemical action in each case. How is the gold recovered from the solutions, and how is it purified? Point out any resemblances between the compounds of gold and those of mercury.

12. Give an account of the occurrence, separation, and properties of the elements of the helium family. What experimental evidence is there that the molecule of helium is monatomic? Explain clearly the principle on which the method is based.

PRACTICAL CHEMISTRY.

WEDNESDAY, APRIL 5, 1905: 10 *a.m.* to 4.30 *p.m.*

1. Test the sample of zinc dust (A) for metallic impurities, and determine the percentage of metallic zinc contained in it. (Zinc dust containing 1 per cent. of *ferrum redactum*.)

2. Identify the ingredients of the mixture (B). (Calcium citrate, urea nitrate and starch; calcium tartrate, uric acid, lactose; *one* mixture to each candidate.)

THURSDAY, APRIL 6th, 1905 : 10 *a.m. to* 4.30 *p.m.*

1. Investigate the substance (C), and determine the percentage of one of its constituent elements by a process which does not involve the use of a combustion furnace. (Benzenesulphonamide.)

2. Analyse qualitatively, and if possible identify, the mineral (D). (Apatite.)

FRIDAY, APRIL 7th, 1905 : 10 *a.m. to* 4 30 *p.m.*

1. The solution (E) contains the chloride and the hypo-chlorite of sodium. Determine the quantity of each salt contained in one litre of the solution.

2. From the aromatic amine (G) supplied to you prepare a specimen of the corresponding phenol. Determine as many of the physical constants of the phenol as you can. (Para-toluidine.)

Final Examinations for the Associateship.

Branch "A."—Mineral Chemistry.

TUESDAY, APRIL 4th, 1905 : 10 *a.m. to* 4.30 *p.m.*

Make a qualitative analysis of the basic slag ; and determine the amounts of the three more abundant metallic constituents. (*The acid constituents should be preserved for to-morrow's work.*)

WEDNESDAY, APRIL 5th, 1905 : 10 *a.m. to* 4.30 *p.m.*

Determine the silica, phosphoric acid, and sulphur in the slag.

THURSDAY, APRIL 6th, 1905 : 10 *a.m. to* 4.30 *p.m.*

Identify the substances (J) (Cuprous sulphocyanate) and (K) (Barium borotungstate). and estimate the proportions of two elements in (J).

FRIDAY, APRIL 7th, 1905 : 10 *a.m. to* 4.30 *p.m.*

1. Find the amount of silver in the specimen of lead oxide (L).

2. Determine the quantities of nitrite and nitrate in the alkaline salt (M).

No Candidate was Examined in Branch "B" (Metallurgical Chemistry), or in Branch "C" (Physical Chemistry).

Branch "D."—Organic Chemistry.

TUESDAY, APRIL 4th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Determine, by a volumetric method, the percentage of amyl nitrite in the alcoholic solution (A).

2. Investigate the substance (B) as completely as time will permit. (Amygdalin.) Leave on your bench purified specimens of as many products as you can obtain from it.

WEDNESDAY, APRIL 5th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. The substance (C) is the acetyl derivative of an amine. (Acetnaphthalide.) Determine (*a*) the percentage of acetyl contained in the substance, and (*b*) the molecular weight of the amine by a chemical method.

2. Examine the sample of spirit (D) for impurities, and prepare from it a specimen of pure alcohol. (Ethyl alcohol containing small quantities of aldehyde and pyridine.)

THURSDAY, APRIL 6th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. The solution (E) contains the calcium salt of an organic acid. (Calcium lactate). Prepare a specimen of the zinc salt, and estimate the percentage of zinc contained in it.

2. Identify the substance (G). Prepare two characteristic derivatives, and determine their physical constants as completely as time will permit. (Monomethylaniline, diphenylamine ; *one* to each candidate.)

FRIDAY, APRIL 7th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Make a qualitative analysis of the substance (H), and determine its quantitative composition as fully as time will permit. (Sodium arsenio-tartrate.) (*Before beginning the quantitative work submit a scheme of analysis to the Examiners.*)

2. Determine the specific rotation of the substance.

Branch "E."—The Analysis of Food and Drugs, and of Water.

TUESDAY, APRIL 4th, 1905: 10 *a.m. to* 4 30 *p.m.*

1. Make an analysis of the sample of cheese.

2. Identify the given preparation. (Iron ammonium citrate, and iron potassium tartrate; *one* to each candidate.

WEDNESDAY, APRIL 5th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Report on the alcoholic strength of the rum, and determine the solid residue, volatile acid, and proportion of "ethers," in relation to 100,000 volumes of absolute alcohol.

2. Examine the wine for poison and determine the quantity present. (Tartar emetic, quinine arsenite: *one* in each sample.)

THURSDAY, APRIL 6th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Analyse the aperient mineral water (P), and report on the amount of the chief saline constituents.

2. Ascertain what alkaloid is present in the given liquid (R). (*a*) (Strychnine, or (*b*) brucine.)

FRIDAY, APRIL 7th, 1905: 10 *a.m. to* 4.30 *p.m.*

1. Examine the marmalade: determine the proportions of cane and invert sugar and state whether "glucose" is present.

2. Ascertain the ratio of soda to boric acid in the preservative powder (S).

Candidates in Branch "E" of the Final Examinations were required to pass an Examination in Therapeutics, Pharmacology, and Microscopy.

SATURDAY, APRIL 8th, 1905: 10 *a.m. to* 1 *p.m.*

1. Determine the nature of the fabric A. Examine microscopically the stains upon it, and state their most probable origin. Leave prepared slides on your bench.

2. Determine, so far as you can by microscopical means alone, the composition of the proprietary foodstuff B, and report upon the condition of the particular sample supplied. Leave prepared slides on your bench.

3. Report fully upon the prepared slides C and D.

4. Discuss, and illustrate by examples, the phenomenon of antagonism in the physiological action of drugs. Distinguish between true antagonism and the action of antidotes in general.

5. Give the full medicinal and the average fatal doses, for an adult, of the following: Chloral hydrate, carbolic acid, hydrocyanic acid (in two per cent. solution), tartar emetic, codeia.

Candidates in this Branch were examined practically and interrogated orally as to the recognition of Chemicals and Drugs.

14.—List of Universities, Colleges and Institutions, recognised for the Training of Candidates for the Examinations of the Institute of Chemistry.

Aberdeen	The University.
Aberystwyth	The University College of Wales.
Bangor	University College.
Belfast	Queen's College.
Birmingham	The University.
Bristol	Merchant Venturers' Technical College.
,,	University College.
Cambridge	The University.
Cardiff	University College.
Cork	Queen's College.
Dublin	Royal College of Science for Ireland.
,,	Trinity College.
Dundee	University College.
Edinburgh	The Heriot-Watt College.
,,	The University.
Galway	Queen's College.
Glasgow	The University.
,,	The Glasgow and West of Scotland Technical College.
Leeds	The University.
Liverpool	The University.
London	City and Guilds Institute, Central Technical College.
,,	City and Guilds Institute, Finsbury Technical College.
,,	King's College.
,,	Royal College of Science.
,,	*School of the Pharmaceutical Society of Great Britain.
,,	University College.
Manchester	Owens College (Victoria University).
Newcastle-on-Tyne	Armstrong College (Durham College of Science).
Nottingham	University College.
Oxford	The University.
Sheffield	The University.
St. Andrew's	The University.

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*Recognised for Chemistry only.

The Laboratories of the Institute of Chemistry

May be used by other Examining Bodies and Institutions for Examination Purposes.

Particulars may be obtained from the Registrar, 30, BLOOMSBURY SQUARE, LONDON, W.C.

The Library

Is open for the use of Fellows, Associates and Registered Students, between the hours of 10 a.m. and 6 p.m. on every week-day, except on Saturday afternoons and during the Examinations.